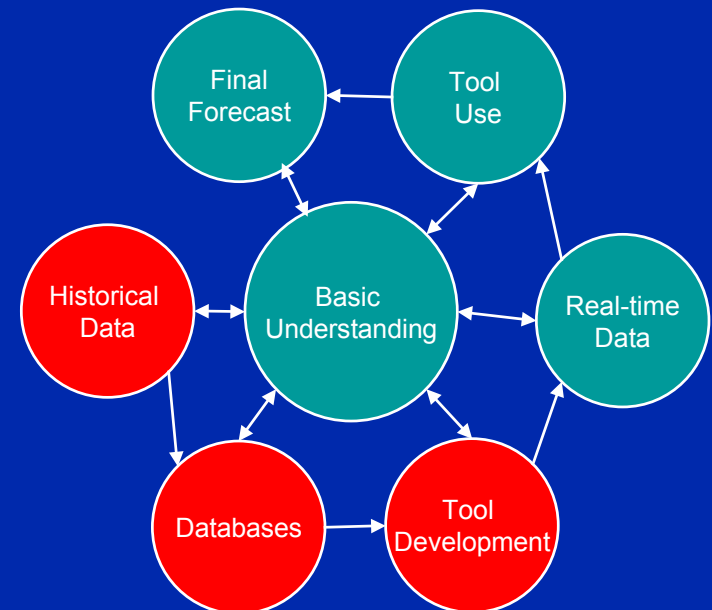


# Session 1B: Development and Use of Objective Forecast Tools

Goal: Learn how to create and use objective forecast tools

- Part 1: Creating and using databases (9:00 to 10:20)
  - Clinton MacDonald and Dianne Miller
- Part 2: Creating tools (10:40 to 12:00)
  - Joe Cassmassi



# Introduction – Tools

- Objective
  - Persistence
  - Criteria, thresholds, rules of thumb
  - Regression equations\*
  - Classification and Regression Trees (CART)\*
  - Neural networks
  - Numerical modeling
- Subjective
  - Climatology
  - Conceptual and experience

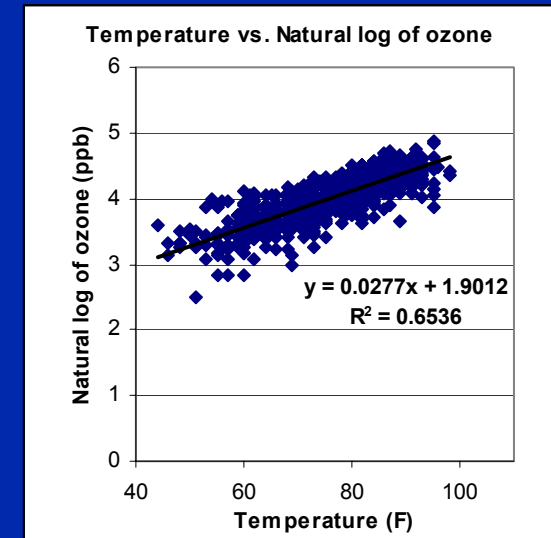
\*Focus of this course

# Introduction – Regression

## PM<sub>2.5</sub> Regression Equation

$$\begin{aligned} \text{PM}_{2.5} (\mu\text{g}/\text{m}^3) = & 53.429 - 0.31 * \text{Tmax} \\ & - 0.541 * \text{SurfaceWS} + 1.008 * (\text{T@700mb} - \text{Tmin}) \\ & + 0.838 * (\text{Stability}) + 0.183 * \text{Td@700mb00Z} - 0.292 * \text{WS@850mb00Z} \end{aligned}$$

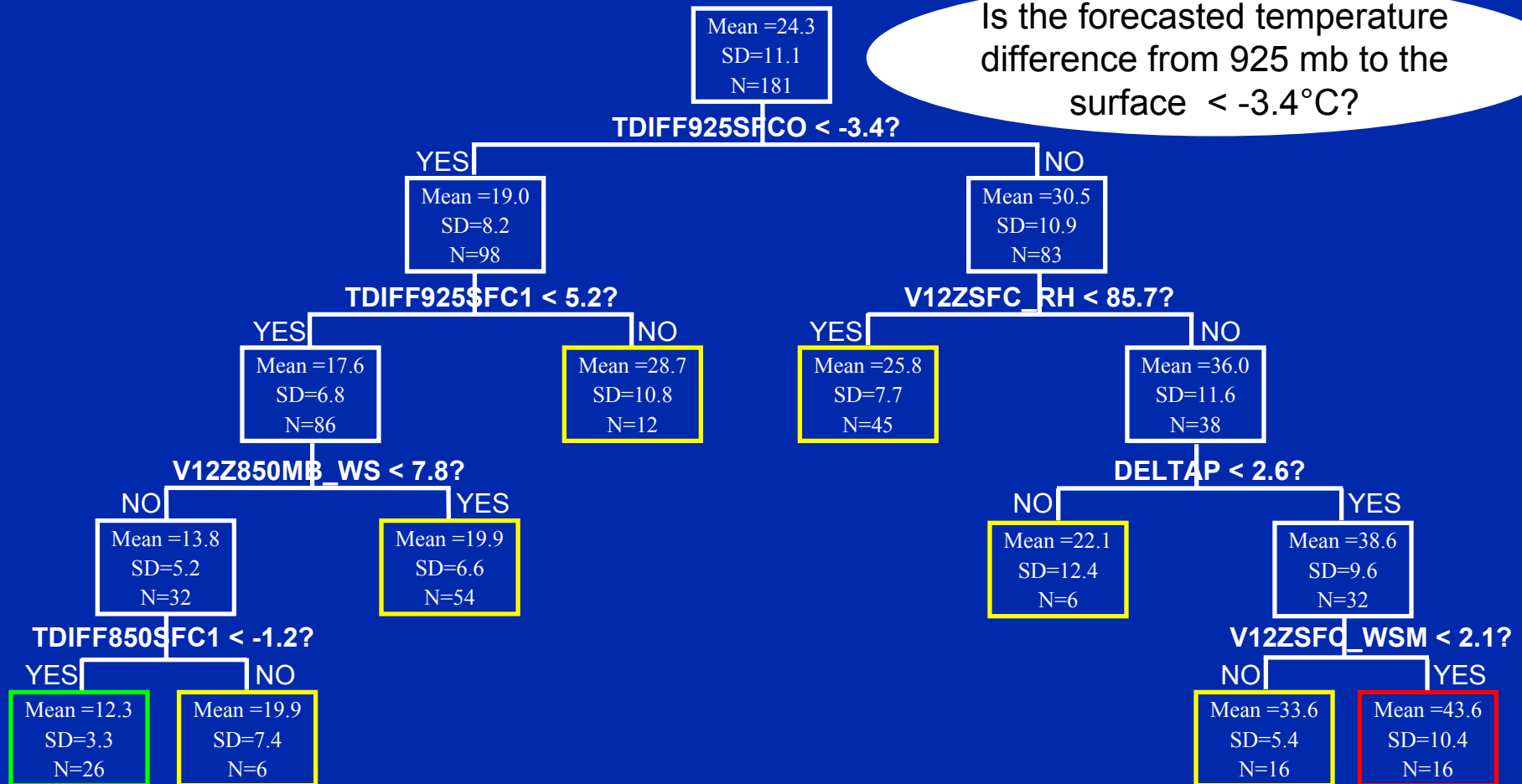
Variable	Description
Holiday	1 for Valentine's Day, Martin Luther King, Jr. Day, Presidents' Day, Veterans' Day, and Super Bowl Sunday. 2 for Thanksgiving weekend and Christmas Eve through New Year's Day. 1 for weekends immediately preceding or following any of the above holidays. 0 for all other days.
Precip	Forecasted precipitation in inches during the 24-hr forecast period.
Tmax	Forecasted daytime maximum temperature (°F)
SurfaceWS	Average resultant wind speed from 12Z to 00Z (0500 to 1700 MST)
T@700mb	Temperature at 700 mb at 12Z (0500 MST) (°C)
Tmin	Forecasted or observed minimum temperature (°C)
Stability	Temperature at 700 mb at 00Z (1700 MST) (°C) minus the forecasted daytime maximum temperature (°C) at the surface
Td@700mb00Z	Dew-point temperature at 700 mb at 00Z (1700 MST) (°C)
WS@850mb00Z	Wind speed at 850 mb at 00Z (1700 MST) (m/s)



$$Y = m_1 x_1 + m_2 x_2 + b$$

# Introduction – CART

## CART classification $PM_{2.5}$ in San Diego



# How these tools are developed (1 of 2)

- Tools are developed by investigating the historical relationship between predictor variables (meteorology) and forecast variables (air quality).
- We assume that when meteorological conditions occur in the future, air quality will respond in the same way it has in the past.

# How these tools are developed (2 of 2)

## General Steps:

- Process meteorological and air quality data into a common format (Part 2)
- Quality-control data (Parts 1 and 2)
- Create one data table ready for statistical packages (Part 1)
- Quality-control data (Parts 1 and 2)
- Run statistical software on merged data to create tools (Part 2)
- Test, evaluate, and re-develop tools as needed (Part 2)